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# THE CENTRAL AFRICAN JOURNAL OF MEDICINE

## ORIGINAL ARTICLES

### Behavioural factors associated with cutaneous anthrax in Musadzi area of Gokwe North, Zimbabwe.

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#### Abstract

**Objectives:** To determine behaviour factors for contracting human cutaneous anthrax among residents of Musadzi area.

**Design:** We conducted a matched case-control study for age, sex, and village.

**Setting:** A rural community in Musadzi area of Gokwe North district.

**Subjects:** We interviewed 35 cases and 35 controls. A case was defined as any resident/visitor of Musadzi, diagnosed with anthrax between 9 September and 10 November 2004. A control was any resident who had not been diagnosed with anthrax and had no lesions suggestive of anthrax on day of the interview.

**Main Outcome Measures:** Behaviour factors associated with contracting anthrax.

**Results:** In September 2004, cattle were reported to be dying in Musadzi area. *Bacillus anthracis* was positively identified in a blood smear from some of the carcasses. The attack rate among humans was 5%. Risk factors associated with contracting anthrax were: skinning of animals that had died from unknown causes AOR=3.8 (95% CI:1.3-10.7); preparation of the meat for cooking (AOR=3.1 (95% CI:1.16-8.4); preparation of the meat for drying AOR=2.7 (95% CI:1.0081-7.4); belonging to a religious or ethnic sect that allow handling of meat from animals that had died from unknown causes (AOR=5.2 (95% CI:1.8-14.8).

**Conclusion:** The human anthrax outbreak was secondary to an anthrax epizootic occurring in cattle. The Ministry of Health activated the local zoonotic committee, carried out anthrax awareness campaigns, supervised the destruction of carcasses, disinfected potentially contaminated sites and introduced a participatory health education tool on anthrax. The veterinary department quarantined and vaccinated cattle.

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#### Introduction

Anthrax is a bacterial disease caused by *Bacillus anthracis*. It is primarily a disease of herbivores, although few, if any, warm-blooded species are entirely immune to it.<sup>1</sup> From earliest historical records until the development of an effective veterinary vaccine midway through the 20<sup>th</sup> century, anthrax was one of the foremost causes of uncontrolled mortality in domestic

animals worldwide.<sup>1</sup>

Humans contract anthrax directly from animals or through animal products.<sup>1,2</sup> The disease is still enzootic in most countries of Africa and Asia, a number of European countries, and countries/areas of the American continent and certain areas of Australia. It still occurs sporadically in many other countries.<sup>4</sup>

Zimbabwe is currently experiencing an unprecedented increase in the number of human

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anthrax outbreaks in several parts of the country. Despite this, not much has been documented and published regarding probable risk factors for contracting anthrax that may guide targeted interventions. Zimbabwean authorities, as well as health officials in many other countries, regard even a single case of anthrax to be an outbreak. The local health officers are required to investigate and institute epidemic control measures as soon as any health provider reports a suspected anthrax case. Early control is required because anthrax has a case fatality of 20% in humans and nearly 100% in cattle if untreated.<sup>1</sup> This makes the disease of major public health and veterinary health importance. Health providers are required to notify all suspected anthrax cases to central government.

On the 29<sup>th</sup> of September 2004 health officials in Mashonaland West Province of Zimbabwe reported that persons with suspected cutaneous anthrax from Musadzi are in the Midlands Province had been seen at one of their health centres. By the time the province moved in to assist, the local clinic had seen 13 cases. *Bacillus anthracis* was identified in blood smear of one of the animals by the veterinary department. A further 32 cases were identified during a search for additional cases by the provincial support team. All human cases were epidemiologically linked to cattle that had died of unknown causes.

A study to investigate the behaviour factors associated with contracting human cutaneous anthrax in the Musadzi area of Gokwe was done. This paper reports the results of these investigations.

## Materials and Methods

We used a matched case-control study design. We matched the cases and controls according to age, sex and village of residence. We defined a case as any person who had been to Musadzi area and developed a disease manifested at first by itching of an exposed skin surface, followed by a painful lesion, which became popular, then vesiculated, and eventually developed into a black depressed eschar in two to six days. To meet the case definition, clinical disease had to occur during the period 9 September to 10 November 2004. A control was any person who had not been diagnosed with anthrax during the period 9 September to 10 October, who resided in the same village, and who was of the same age and sex as a case. The controls were not supposed to have any lesions suggestive of anthrax at the time they were interviewed.

All cutaneous anthrax cases that could be traced were included in the study. Controls were conveniently selected from the nearest neighbouring households of the case's household. Contracting anthrax was the outcome measure in this study.

We collected data through key informant interviews and an interviewer-administered questionnaire. Data were analyzed for frequencies, means, and associations using Epi Info 2005. A p-value of 0.05 or less was

considered statistically significant. Matched analysis was carried out with odds ratios adjusted for sex, age, and village of residence.

## Ethical Consideration

The researchers obtained permission to carry out the study from the Provincial Medical Director Midlands, Department of Community Medicine (UZ), and the local traditional leadership. We obtained verbal consent from all the respondents. If the respondent was a minor, we obtained permission from the guardian.

## Results

We interviewed 35 cases and 35 controls. In each group, there were 27 males and eight females. The respondents were from nine villages. The respondents' demographical information is shown in Table I. All respondents except one had attained at least a primary school level of education. Most (38 or 55%) of the respondents indicated that they belonged to a religious grouping that restricted consumption of meat from animals that die of unknown causes.

*Table I: Demographic data of Musadzi anthrax cases and controls September 2004.*

	Cases	Control
Males	27	27
Females	8	8
Median age	23 (Q <sub>1</sub> =13; Q <sub>3</sub> =34)	21 (Q <sub>1</sub> =15; Q <sub>3</sub> =26)
Median years of Staying in area	17 (Q <sub>1</sub> =7; Q <sub>3</sub> =22)	18 (Q <sub>1</sub> =12; Q <sub>3</sub> =32)
Mean Household size	7	8

The population at risk was 996. The overall attack rate was 5%, although the village that had the greatest burden of anthrax had an attack rate of 13%. The anthrax lesions were located on the hands or fingers of 42 (82%) respondents, on the faces of eight (16%), and on thighs of three (5%).

### Geographical Spread of Cases.

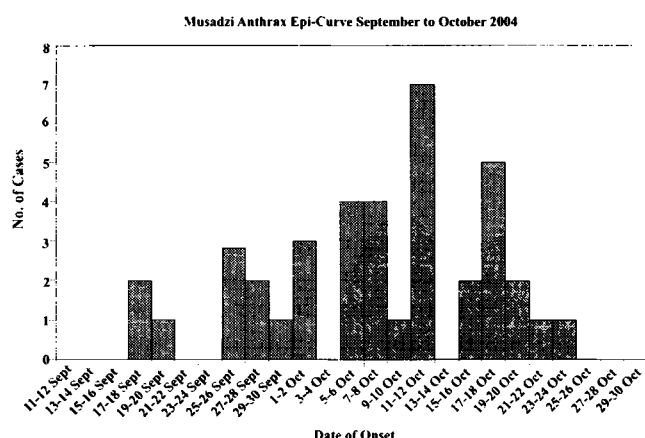
Cattle deaths had occurred in all the villages where the human cases came from. The majority of the cattle deaths occurred in Machimbirike Village.

### Outbreak Time Line.

The index case noticed a pimple developing on 17 September 2004. The individual had assisted in the skinning of the first bovine that died on 12 September 2004. The bovine had died at a borehole in Machimbirike Village. The animal drinking water trough at the borehole was used to store the meat during processing. Shortly afterwards bovines that used the borehole began dying. Humans with cutaneous anthrax

started reported at the local clinic for treatment in the third well of September 2004. The epidemic curve is shown in Figure I.

*Figure I: Musadzi anthrax epidemic curve September to October 2004.*



### History of Handling Meat or Other Animal Products.

Twenty six (38%) of the respondents handled meat from bovines that had died of unknown cases. Another 26 (38%) had assisted in the skinning of the carcasses. Hide preparation was done by 37 (57%) of the respondents. Thirty seven (57%) respondents had assisted in the processing of the meat for drying. Preparation of the meat for cooking was done by 37 (57%) of the respondents. Fourteen (27%) respondents

still had the meat from animals that had died from unknown causes at their households at the time of the study.

### Knowledge of Anthrax.

The sign of anthrax most cited was pimple development mentioned by 67% (48) of the respondents. Ten per cent, (seven) of the respondents did not know any signs or symptoms associated with human anthrax.

Forty percent (28) of respondents knew something about anthrax before the outbreak. Lack of vaccination was mentioned by two (3%) respondents, lack of dipping of animals by six (9%), and overgrazing by two (3%) as the causes of anthrax in animals. Thirty seven (57%), did not know the cause of anthrax in animals. Forty two (60%) respondents considered consumption of meat from animals that die from unknown causes unsafe, whilst (17 (24%) thought it was safe and 3% (2) respondents were not sure as to whether it was safe.

### Factors Associated with Contracting Cutaneous Anthrax.

Skinning carcasses of bovines that had died of unknown causes, preparing meat for cooking, preparing meat for drying, not belonging to a religious sect that prohibited consumption of meat from animals that had died from unknown causes were significantly associated with contracting anthrax ( $p < 0.05$ ). the risk factors for contracting anthrax are shown in Table II.

*Table II: Risk factors for contracting anthrax Musadzi September to November 2004.*

Factor	Cases	Control	AOR	p value	(95% CI)
Skinning	18	8	3.8	0.009	(1.3-10.7)
Preparing meat for cooking	23	14	3.1	0.02	(1.16-8.4)
Preparation of meat for drying	23	26	2.7	0.04	(1.0081-7.4)
Religious sect allows consumption of Meat belonging to a household where there were cattle deaths	17	7	2.9	0.05	(1.07-9.6)
Residing in a village where there were cattle deaths	32	28	4	0.08	(0.7-20.8)
Preparation of hide for drying	6	5	1.3	0.6	(0.3-4.8)
<b>Trade in infected meat</b>	<b>20</b>	<b>14</b>	<b>1.8</b>	<b>0.4</b>	<b>(0.4-7.4)</b>

## Discussion

Exposure to carcasses of cattle that had died from

unknown causes during skinning, processing or preparation of the meat for cooking or drying was the cause of human anthrax in Musadzi.

The human anthrax cases were recorded in eight villages. All these cases were epidemiologically linked to handling carcasses of animals that had died of unknown causes.

Figure I shows that Musadzi had the anthrax outbreak from 17 September to 26 October 2004. During this period, the epidemic curve has irregular peaks that may reflect the timing of the exposure.

### **History of Handling Meat or Other Animal Products.**

The position of the lesion 83% (42) on patients' fingers indicates infection during handling of the infected bovine carcasses. The findings are consistent with the findings of Mwenye *et al.* In a study carried out at Mrew (Chikupo and Ngandu village) in which the investigators reported that skinning and cutting meat of an animal alleged to have shown symptoms of anthrax, eating contaminated meat, or handling contaminated meat in the process of selling it were associated with contracting anthrax.<sup>5</sup>

In a study of human behavioural factors implicated in outbreaks of human anthrax in Northern Ghana, investigators reported that a significant proportion of the respondents believed that animals that die of unknown causes can be eaten because they serve as an inexpensive meat source and are safe if cooked with herbs.<sup>6</sup> This is in contrast with the motivation factor for trading in such meat in the Musadzi study population, of which most of the adult respondents thought the meat was not a cheap and safe source of nutrition. However, purchasing such meat was the expected societal method of assisting a fellow village raise capital to replace the animal that person had lost.

### **Knowledge of Anthrax.**

Our study also revealed that people associated anthrax with the breakdown of dipping services, which is consistent with findings of a study during a 1978 to 1980 anthrax outbreak in Zimbabwe when many lay people thought that the breakdown of dipping services contributed to the anthrax outbreak.<sup>7</sup> However, the current state of knowledge indicates that livestock dipping itself does not contribute to preventing anthrax.

### **Factors Associated with Contracting Cutaneous Anthrax.**

Activities in which the respondent handled meat were significant risk factors for contracting anthrax. This may also be because the chances of injuries and introducing *Bacillus anthracis* are high when doing these activities. Belonging to religious sects that restrict their members from handling carcasses of animals that die of unknown causes was protective. However, the protection could be eroded by community members who butcher their moribund animals. Butchering moribund animals gives an impression that a healthy animal has been slaughtered and community members whose religions restricts

handling and consumption of animals that die of unknown causes may purchase meat from such animals and get infected.

### **Limitation of the Study.**

We did this study during the outbreak, and this could have affected the knowledge of the respondents as health promotion activities were being done at the same time. However, the arrangement also minimized recall bias on the part of the respondents.

### **Conclusion**

The outbreak of human cutaneous anthrax reported on here, was secondary to an epizootic of anthrax that was occurring in cattle. Risk factors for human anthrax included butchering of moribund animals, handling the carcasses, meat and other animal products from animals that had died of unknown causes. The most dangerous risk behaviour was skinning since those people who skinned the dead animals were 3.8 times more likely to have cutaneous anthrax than people who did not skin the dead animals. The epidemic curve shown in Figure I is consistent with intermittent exposure, as the period between the peaks is approximately equal to the incubation period.

### **Recommendations**

The provincial health office should develop a health-promotion package on anthrax targeting the undesirable behaviours promoting the spread of anthrax. The community should be encouraged to come up with alternative ways of assisting each other than selling/buying meat from diseased animals. The religious and cultural taboos discouraging handling and consumption of meat from animals that die of unknown causes should be reinforced. The community should be discouraged from butchering moribund animals but otherwise should be encouraged to report to the Veterinary Department as well as Ministry of Health at local level of all animal deaths. Carcasses of these animals should be burnt under supervision. Community surveillance structures should be set up to enable early detection of zoonotic diseases. Further research on the environmental determinants of anthrax outbreaks should be conducted.

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